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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/879,928 | 06/14/2001 | C. Ward Trussell JR. | NVL 3247 | 4460 |

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DEPARTMENT OF THE ARMY,CECOM
INTELLECTUAL PROPERTY DIVISION
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| EXAMINER | |
|---|---|
| WARREN, MATTHEW E | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2815 | |

DATE MAILED: 03/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/879,928 | TRUSSELL JR. | |
| | Examiner | Art Unit | |
| | Matthew E. Warren | 2815 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

This Office Action is in response to the RCE and Amendment filed on January 13, 2004.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent claims 1, 5 and 6 include the limitation that the laser slab has a rectangular cross-section. The applicant then argues that the specification and drawings suggest such a teaching. The examiner cannot find evidence within the specification which specifically and positively supports that limitation. The specification only states that a side surfaces are polished and the top and bottom surfaces are roughened (and does not state that the side surfaces are polished flat). That teaching does not support that the slab has a rectangular cross-section because certainly have two opposing polished side portions and two opposing roughened top and bottom portions. The drawings do not further support the limitation because there is nothing in them to indicate that the slab has a rectangle cross-section. The figures only show that the laser slab in a side view and based on that view, one of ordinary skill in the art might

determine that the slab is cylindrical. For these reasons the added limitation of the slab having a rectangular cross-section will be ignored.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fields et al. (US 5,139,609) in view of Marchitto et al. (US 6,387,059) and Robertson (US 6,039,632).

With respect to claim 1, Fields et al. shows (fig. 1) a diode array end pumped multiple mode slab laser comprising a laser diode (2) having at least one diode bar (18) for providing laser pump light in a vertical and horizontal direction to the optical axis, a first cylindrical lens (4) for collimating the laser pump light in the vertical direction on the optical axis after the laser diode bar (col. 5, lines 35-40), and a second cylindrical lens (6) on the optical axis perpendicular to and after the first cylindrical lens for collecting laser pump light output from the first cylindrical lens and focusing onto a laser slab as focused laser pump light. A laser cavity is provided on the optical axis after the second cylindrical lens comprising a laser slab of solid state crystal (8) with a length, the slab accepting as input the focused laser pump light at the input side with unabsorbed pump light reflected within the laser slab and outputting from the output side absorbed laser

energy (26), whereby the laser pump light remains collimated perpendicular throughout the laser slab and the pump light further includes laser mode overlap for all of the laser slab length. Fields does not specifically teach that the laser slab of solid-state crystal has polished input and output sides. Marchitto et al. discloses (col. 20, line 7 – col. 23, line 33) an end pumped laser in which a laser slab of crystal has polished ends to produce a collimated beam from the crystal (col. 21, lines 5-23). Neither Fields nor Marchitto disclose the laser slab further having rough ground top and bottom surfaces and polished sided surfaces. Robertson discloses (col. 4, lines 16-30) a rectangular laser slab in which the upper and lower sides of the crystal are polished and the side surfaces are roughened. With this configuration, the light propagates in a generally axial direction through the slab and ultimately reduces heat generation in the slab. Although Robertson polishes the upper and lower surfaces instead of roughening the upper and lower surfaces, depending on how the crystal is oriented or from which direction the cavity is viewed, the slab of Robertson my have roughened upper and lower surfaces. Such a configuration when viewed in that manner will produce light collimated in the vertical direction and produce laser mode overlap for focused laser pump light absorption along all of the slab length. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the laser slab crystal of Fields by polishing the ends of the crystal as taught by Marchitto to produce a collimated output beam from the laser slab of crystal. It would have also been obvious to modify the laser slab of Fields or Marchitto by forming the slab having polished upper

and lower surfaces and roughened opposing side surfaces as taught by Robertson to minimize heat generation in the slab.

With respect to claim 2, Fields et al. discloses (col. 5, lines 55-63) that the laser cavity further includes a Q-switch having input and output ends on the optical axis, with dichroic coatings at said input and output ends, the Q-switch producing peak power pulses.

With respect to claim 3, Fields et al. discloses (col. 5, lines 55-63) a non-linear crystal to produce additional wavelengths.

With respect to claim 4, Fields et al. discloses (col. 5, lines 55-63) that a non-linear crystal is further provided after the laser cavity on the optical axis for producing additional wavelengths.

With respect to claim 5, Fields et al. discloses (col. 5, line5 – col. 6, line 19) a diode array end pumped multiple mode slab laser technique comprising the steps of generating laser pump light in the vertical and horizontal direction to the optical axis, collimating the laser pump light in the vertical direction, collecting the laser pump light output from a first cylindrical lens (4) and focusing onto a laser slab (8) as focused laser pump light, and accepting as input the focused laser pump light into a laser cavity including at least a laser crystal (8) having an input and output side, where unabsorbed pump light is reflected within the laser crystal and outputting from the output side absorbed laser energy, Fields does not specifically teach that the laser slab of solid state crystal has remain collimated throughout the crystal. Marchitto et al. discloses (col. 20, line 7 – col. 23, line 33) an end pumped laser in which a laser slab of crystal

has polished ends to produce a collimated beam from the crystal (col. 21, lines 5-23). Neither Fields nor Marchitto disclose the laser slab further having rough ground top and bottom surfaces and polished sided surfaces. Robertson discloses (col. 4, lines 16-30) a rectangular laser slab in which the upper and lower sides of the crystal are polished and the side surfaces are roughened. The laser light is focused into the input end and remains collimated throughout the slab so that the light reflects off of the side (polished) surfaces through the length of the slab. With this configuration, the light propagates in a generally axial direction through the slab and ultimately reduces heat generation in the slab. Although Robertson polishes the upper and lower surfaces instead of roughening the upper and lower surfaces, depending on how the crystal is oriented or from which direction the cavity is viewed, the slab of Robertson my have roughened upper and lower surfaces. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the laser slab crystal of Fields by polishing the ends of the crystal as taught by Marchitto to produce a collimated output beam from the laser slab of crystal. It would have also been obvious to modify the laser slab of Fields or Marchitto by forming the slab having polished upper and lower surfaces and roughened opposing side surfaces as taught by Robertson to minimize heat generation in the slab.

With respect to claim 6, Fields et al. shows (fig. 1) an end pumped multiple mode slap laser comprising at least one diode bar (18) for providing laser pump light in a vertical and horizontal direction to the optical axis, a first cylindrical lens (4) for collimating said laser pump light in said vertical direction on said optical axis after said

laser diode bar 9col. 5, lines 35-40), a second cylindrical lens (6) on said optical axis perpendicular to and after said first cylindrical lens for receiving said laser pump light from said first cylindrical lens for further direction into a laser slab (8). Said laser slab has a length. Fields does not specifically teach that the laser slab of solid-state crystal has polished input and output sides. Marchitto et al. discloses (col. 20, line 7 – col. 23, line 33) an end pumped laser in which a laser slab of crystal has polished ends to produce a collimated beam from the crystal (col. 21, lines 5-23). Neither Fields nor Marchitto disclose the laser slab further having rough ground top and bottom surfaces and polished sided surfaces. Robertson discloses (col. 4, lines 16-30) a rectangular laser slab in which the upper and lower sides of the crystal are polished and the side surfaces are roughened. With this configuration, the light propagates in a generally axial direction through the slab and ultimately reduces heat generation in the slab. Although Robertson polishes the upper and lower surfaces instead of roughening the upper and lower surfaces, depending on how the crystal is oriented or from which direction the cavity is viewed, the slab of Robertson my have roughened upper and lower surfaces. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the laser slab crystal of Fields by polishing the ends of the crystal as taught by Marchitto to produce a collimated output beam from the laser slab of crystal. It would have also been obvious to modify the laser slab of Fields or Marchitto by forming the slab having polished upper and lower surfaces and roughened opposing side surfaces as taught by Robertson to minimize heat generation in the slab.

***Response to Arguments***

Applicant's arguments filed with respect to claims 1, 5, and 6 have been fully considered but they are not persuasive. The applicant primarily asserts that the combined references of Marchitto, and Robertson cannot be combined to cure the deficiencies of fields. Marchitto was cited to cure the deficiency of Fields in that the laser slab has polished ends to produce the desired collimated light. The teaching of the polished side surfaces and roughened top and bottom surfaces was not relied upon in Marchitto. Robertson cured the deficiencies of Fields and Marchitto in that two opposing surfaces (top and bottom) of a rectangular laser slab were polished and the opposing side surfaces were roughened. It is noted that the applicant's claimed invention requires a differing configuration in which the side surfaces are polished and the top and bottom surfaces are roughened, however the teaching of Robertson is very relevant and can still be applied. Like the applicant's claimed invention, Robertson teaches a slab in which opposing sides are polished while another set of opposing sides are roughened to produce total internal reflection within the slab. In the case of Robertson, collimation of the beam occurs in the axis opposite of the applicant's claimed invention. The examiner is not suggesting that the slab of Robertson be rotated to meet the limitations of the applicant's invention, but is suggesting that the system of polishing and roughening be rotated on specific surfaces as taught by Robertson to produce collimation in the desired axis. In essence, if roughening the sides of the slab of Robertson produces collimated beams in the horizontal direction, then roughening the top and bottom surfaces of the slab produces collimated beams in the vertical

direction. Also, depending on the direction in which the system is viewed, horizontal collimation of the beam may also be viewed as vertical collimation if the system is rotated axially by 90 degrees. Robertson teaches that the system of roughening and polishing desired surfaces not only produces a collimated beam in the desired axis but also reduces heat generation in that axis as well. The references have therefore been properly combined and show all of the elements of the claims.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (571) 272-1737. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MEW
March 5, 2004

Tom Thomas
Supervisory Patent Examiner
Technology Center 2800